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What Is New About The New Literacies of Online Reading Comprehension?

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### What Is New About The New Literacies of Online Reading Comprehension?

Change defines literacy (Coiro, 2003; Hartman, 2000; Leu, 2000; Rosenblatt, 1938). Our lives change in fundamental ways as we become literate, expanding access to information, communication, and action (Freire, 1976, 1985; LeVine, LeVine, & Schnell, 2001).

Since understanding change is at the core of what we do, it is ironic our research community has largely ignored the extensive changes taking place to literacy in a digital, networked, multi-modal, and multi-tasking world of information and communication. The nature of literacy is undergoing profound change and we have little research or solid theory to inform our understanding of the consequences for classroom practice (Reinking, 1998).

New information and communication technologies (ICTs), such as the Internet (Leu, 2000), wikis (Thomas, in press), blogs (Mortensen, in press), search engines (Henry, 2006), instant messaging (Jacobs, in press), email (Tao & Reinking, 2000), online gaming worlds (Steinkuehler, in press) require new literacies and have become important new contexts for literacy, learning, and life (International ICT Panel, 2001). Few, if any, of these new literacies have found their way into the classroom (Cuban, 2001; Madden, Ford, Miller, & Levy, 2005). Indeed, many seem to be resisted overtly by deliberate educational policies (Leu, in press) or covertly by educators who sometimes are not nearly as literate with the Internet as the students they teach (Chandler-Olcott & Mahar, 2003).

The irony of ignorance may be greatest in research on reading comprehension. While we are beginning to establish extensive theoretical and research literatures on the reading comprehension of traditional texts to inform practice (Biancarosa & Snow, 2004; Kamil, Mosenthal, Pearson, & Barr, 2000; National Institute of Child and Human Development [NICHD], 2000; RAND Reading Study Group [RRSG], 2002), there is hardly any research on

the nature of reading comprehension on the Internet or with other ICTs (Coiro & Dobler, in press). The assumption appears to be that reading comprehension is fully isomorphic, offline and online.

Both speculation (Coiro, 2003; Rand Reading Study Group, 2002; International Reading Association [IRA], 2002) and emerging research (Coiro & Dobler, in press; Coiro, 2006; Leu, Castek, Hartman, Coiro, Henry, Kulikowich, & Lyver, 2005) suggest this assumption is misplaced. As the Rand Reading Study Group (2002) concluded, "... accessing the Internet makes large demands on individuals' literacy skills; in some cases, this new technology requires readers to have novel literacy skills, and little is known about how to analyze or teach those skills." (p. 4).

We have failed, however, to provide the educational community with adequate research and theory on the new literacies of reading comprehension on the Internet (Coiro, 2003). That failure has important consequences for education in the twenty-first century when learning is increasingly dependent on the ability to read and comprehend complex information at high levels (Alexander & Jetton, 2002; Bransford, Brown, & Cocking, 2000) and the Internet is now a central source of that information (Lyman & Varian, 2003). As a result of our collective failure, many students go unsupported in developing the new literacies of online reading comprehension in school (Castek, Leu, Coiro, Gort, Henry, & Lima, in press; Leu, in press). This is especially true for those students who require our support the most -- those who have access to the Internet at home the least.

What is new about these new literacies? The answer to this question is only beginning to emerge. We are hampered by a confusing series of overlapping constructs (Coiro, Knobel, Lankshear, & Leu, in press), a limited body of research (Leu, in press), and very few scholars

who study the issue (Hartman, 2005). Moreover, the continuously changing nature of ICTs suggests that even newer literacies will be required from even newer technologies appearing tomorrow, next month, and next year (Leu, 2000). Thus, a complete understanding of new literacies may be a Sisyphean task, never fully attainable.

#### THE INTERNET IS A DEFINING TECHNOLOGY FOR LITERACY AND LEARNING IN THE TWENTY-FIRST CENTURY

We recently passed an important milestone in the history of literacy: in late 2005, the one-billionth individual started reading online (de Argaez, 2006; Internet World Stats: Usage and Population Statistics, n.d.). The rate of this growth has been exponential; most of it took place in just the past five years (Evolution of Online Linguistic Populations, n.d.). In the history of literacy, no other technology for reading, writing, and communication has been adopted by so many, in so many different places, in such a short period of time.

While the Internet fills important personal needs, much of the increase in Internet use has been driven by changes taking place in the workplace. Economic units have had to increase productivity in a globally competitive economy (Friedman, 2005). As a result, the world of work has recently undergone fundamental restructuring (Bruce, 1997; Drucker, 1994; Gilster, 1997; Mikulecky & Kirkley, 1998; The New London Group, 2000).

Traditionally, industrial-age organizations were organized vertically. Decisions were made at the highest levels and then communicated to lower levels, where they were simply carried out without the need for much thought by bottom-tier employees. This wasted much of the intellectual capital within an organization, limiting productivity (The New London Group, 2000).

With restructuring, workplaces have sought to achieve greater productivity by organizing themselves horizontally; empowering teams within lower levels of an organization to make

important decisions related to their work (Mikulecky & Kirkley, 1998; The New London Group, 2000). Members of these teams must quickly identify important problems, locate useful information related to the problems they identify, critically analyze the information they find, synthesize this information to solve the problems, and then quickly communicate the solutions to others, so that everyone within an horizontally structured organization is informed. By requiring all employees to use their ability to read, communicate, and problem solve, economic organizations have increased productivity, allowing some to flourish within intense global competition (Friedman, 2005).

Given these changes, it is no accident that the Internet has rapidly appeared in the workplace; it permits access to the information required to increase productivity (U.S. Department of Commerce, 2002). Of course, using the Internet like this to take full advantage of the intellectual capital each employee possesses has also altered the literacy demands required in the workplace (Leu, et. al, 2004; Mikulecky & Kirkley, 1998). Employers now seek individuals who know how to read, write, and communicate on the Internet to solve problems.

These changes are not insignificant. In just one year (August 2000 to September 2001), use of the Internet at work to read, write, and communicate increased by nearly 60% among all employed adults 25 years of age and older (U.S. Department of Commerce, 2002). Moreover, recent economic data demonstrates the extent to which this restructuring, Internet integration, and changes in literacy practices account for productivity gains during the past decade in the U.S., Europe, and other nations (van Ark, Inklaar, & McGuckin, 2003; Matteucci, O'Mahony, Robinson, & Zwick, 2005).

The Internet has also quickly found its way into homes in the U.S. and other nations. In 2004, nearly 75% of all households in the U.S. had Internet access (Neilson/Net Ratings, 2004).

Usage is especially frequent among adolescents. Eighty-seven percent of all students between the ages of 12 and 17 in the U.S. report using the Internet; nearly 11,000,000 do so daily (Pew Internet and American Life Project, 2005). Similar changes are being found in other developed nations, some of who are far ahead of the U.S. In Japan, for example, Bleha (2005) reports that 98% of all households have Internet access with broadband access that is 16 times faster than that found in the U.S.

The past decade has also found rapid integration of the Internet into school settings. In 1994, only 3% of all K-12 classrooms in the U.S. had Internet access; today 93% do (Parsad, Jones, & Greene, 2005). Of course, increasing Internet access does not necessarily mean that students are being taught the skills necessary to locate, read, and think critically about online information. Indeed, while there is nearly ubiquitous Internet access in U.S. classrooms, new technologies such as the Internet are not often integrated into instruction (Cuban, 2001; Madden, Ford, Miller, & Levy, 2005).

It is clear that the Internet is this generation's defining technology for literacy and learning. It is also clear that classrooms have yet to systematically take up Internet integration, let alone instruction in the new literacies the Internet requires. In fact, those pioneering teachers who have been leading the way with Internet integration focus on the technology aspects of use, not seeing the issue as an instructional issue for literacy at all (Karchmer, 2000).

#### NEW LITERACIES, ICT LITERACY, AND INFORMATION LITERACY AS CONTESTED THEORETICAL SPACE IN AN EMERGING AREA OF STUDY

Several research communities have begun to explore the changes that new technologies, and the social practices they engender, bring to literacy. Scholars from disciplines such as cognitive science (Mayer, 2001), sociolinguistics (Cope & Kalantzis, 2003; Gee, 2003; Kress, 2003;

Lemke, 1998), cultural anthropology (Markham, 1998; Street, 2003; Thomas, forthcoming), and information science (Bilal, 2000; Hirsch, 1999) have identified changes to literacy as they study the consequences for their individual areas of study. As many new heuristics appear, informing this multidisciplinary work, a new perspective about the nature of literacy is beginning to emerge. This perspective, often referred to as “new literacies,” is still in its initial stages but it is clear to most that it will be a powerful one, redefining what it means to be literate in the 21<sup>st</sup> century (Lankshear & Knobel, 2003; Leu, et. al, 2004).

“New literacies” is highly contested space however; the construct means many different things to many different people. To some, new literacies are seen as new social practices (Street, 1995; 1999) that emerge with new technologies. Some see new literacies as important new strategies and dispositions required by the Internet that are essential for online reading comprehension, learning, and communication (Coiro, 2003; Leu, et. al, 2004). Others see new literacies as new Discourses (Gee, 2003) or new semiotic contexts (Kress, 2003; Lemke, 2002) made possible by new technologies. Still others see literacy as differentiating into multiliteracies (The New London Group, 1996) or multimodal contexts (Hull & Schultz, 2002) and some see a construct that juxtaposes several of these orientations (Lankshear & Knobel, 2003). When you combine these uses of “new literacies” with an earlier use of the term by the New Literacies Study Group, and terms such as ICT Literacy (International ICT Literacy Panel), informational literacy (Hirsch, 1999; Kuiper & Volman, in press; Webber & Johnson, 2000), the construct becomes even more challenging to understand. However, most would agree there are at least four defining characteristics of an emerging new literacies perspective.

First, new technologies for information and communication and new environments for their use require us to bring new potentials to literacy tasks that take place within these technologies.

While they may differ on the construct they use, each set of scholars would probably agree that the Internet and other new ICTs require new skills, strategies, dispositions for their effective use.

Second, new literacies are central to full civic, economic, and personal participation in a globalized community. As a result, they become important to study so that we might provide a more appropriate education for all of our students.

Third, new literacies are deictic (Leu, 2000); they regularly change as defining technologies change. The new literacies of the Internet and other ICTs are not just new today, they will be newer tomorrow, even newer next week, and continuously renewed on a schedule that is limited only by our capacity to keep up. Of course, literacy has always changed as technologies for literacy have changed (Manguel, 1996). What is historically distinctive is that by definition, the Internet permits the immediate, nearly universal, exchange of new technologies for literacy. With a single click, a new technology such as Wikipedia can be distributed to everyone who is online. Thus, what may be important in reading instruction and literacy education is not to teach any single set of new literacies, but rather to teach students how to learn continuously new literacies that will appear during one's lifetime.

Finally, new literacies are multiple, multimodal, and multifaceted. Thus, they increase the complexity of any analysis that seeks to understand them and will benefit from analysis that brings multiple points of view to understand them (Labbo & Reinking, 2000). It may also suggest that the area is best studied in interdisciplinary teams as questions become far too complex for the traditional single investigator model (Coiro, Knobel, Lankshear, and Leu, in press).

## TOWARDS AN UNDERSTANDING OF THE NEW LITERACIES OF ONLINE READING COMPREHENSION



The lack of theory and research on the new literacies of online reading comprehension is surprising given the increasing prevalence of the Internet in our lives. It suggests that our field assumes isomorphism between online and offline reading comprehension. Initial studies, now beginning to emerge, challenge this assumption. One study, among highly proficient sixth grade students (Coiro & Dobler, in press), found that online reading comprehension shared a number of similarities with offline reading comprehension but that online reading comprehension also included a number of important differences. A second study (Leu, et. al, 2005), found no significant correlation, among seventh grade students, between performance on a measure of offline reading comprehension and a measure of online reading comprehension (ORCA-Blog) with good psychometric properties. These results also suggest that new skills and strategies may be required during online reading. A third study (Coiro, 2006), using a regression model, found that while offline reading comprehension and prior knowledge contributed a significant amount of variance to the prediction of online reading comprehension, additional, significant variance was contributed by knowing students' online reading comprehension ability. The results of this study are also consistent with the conclusion that new skills and strategies are required during online reading comprehension.

Additional research is now taking place on several, federally funded research grants in the U.S. One of these, the Teaching Internet Comprehension to Adolescents (TICA) Project (Leu & Reinking, 2005), explores the skills and strategies that proficient online readers at the seventh grade level report during online reading comprehension. The project website is available at: <http://www.newliteracies.uconn.edu/iesproject/>

The initial model of online reading comprehension informing this work (Leu, et. al, 2004) proposes preliminary answers to the two questions that are essential to any theory of reading: 1)

What must students acquire to become proficient at online reading? and 2) How do students acquire these skills, strategies, and dispositions?

*What Must Students Acquire to Become Proficient at Online Reading?*

Models of comprehension have traditionally focused their attention on processing internal to the reader, describing major cognitive and linguistic knowledge sources of knowledge (metalinguistic, discourse, syntactic, vocabulary, decoding, etc.) and how each functions during comprehension processing. They have not always situated the reading process in the social practices, texts, or contexts that drive the reading act (Coiro, 2003; RRSg, 2002).

Recent work on online reading comprehension (e.g., Coiro & Dobler, in press; Henry, 2005; Castek, Leu, Coiro, Kulikowich, Hartman, & Henry, 2006; Leu, et. al, 2004; Leu & Reinking, 2005) expands upon traditional comprehension models to include the purposes that drive online reading, the communicative outcomes of online reading, and the continuously changing nature of the skills, strategies, and dispositions that are required during online reading comprehension. This perspective views reading comprehension on the Internet as contextually situated in both the purpose as well as the process:

“The new literacies of the Internet and other ICT include the skills, strategies, and dispositions necessary to successfully use and adapt to the rapidly changing information and communication technologies and contexts that continuously emerge in our world and influence all areas of our personal and professional lives. These new literacies allow us to use the Internet and other ICT to identify important questions, locate information, analyze the usefulness of that information, synthesize information to answer those questions, and then communicate the answers to others.”

(Leu, et. al, 2004, p. 1570)

Within this perspective, new literacies of online reading comprehension are defined around five major functions: 1) identifying important questions; 2) locating information; 3) analyzing information; 4) synthesizing information; and 5) communicating information. These five functions contain the skills, strategies and dispositions that are both distinctive to online reading comprehension while, at the same time, appear to somewhat overlap with offline reading comprehension. What is different from earlier models is that online reading comprehension is defined around the purpose, task, and context as well as the process that takes place in the mind of a reader. Readers read to find out answers to questions on the Internet. Any model of online reading comprehension must begin with this simple observation.

*Identifying important questions.* We read on the Internet to solve problems and answer questions, both large (e.g., “How do we create a better climate for peace in the Middle East?”) and small (e.g., “What is the best price for a ticket to fly from New York to Orlando on December 21?”). Indeed, the fact that online reading comprehension always begins with a question or problem may be an important source of the differences between online and offline reading. Recent work by Taboada and Guthrie (2006) within traditional texts suggests that reading initiated by a question or problem differs in important ways from reading that does not.

*Locating information.* Because the Internet contains vast amounts of information, it requires new online reading comprehension skills and strategies to locate pertinent information (Henry, 2006). Thus, we include in our model of online reading comprehension the strategies that readers use with a search engine, strategies that have been studied by scholars in information science and library and media studies (e.g. Bilal, 2000) and often included by library media specialists in their work on information literacy.

Our initial work has shown that there are at least four general types of reading skills often associated with the location of information on the Internet: 1) knowing how to use a search engine to locate information; 2) reading search engine results; 3) reading a web page to locate information that might be present there; and 4) making an inference about where information is located by selecting a link at one site to find information at another site. Often these intersect. Each requires additional new comprehension strategies that become important while reading online.

The ability to locate information on the Internet is essential to online reading (International ICT Literacy Panel, 2001). Knowing what to look for and ways to access task-relevant information on the Internet is not intuitive, but involves a complex set of skills for which many students are not always adequately prepared (Bilal, 2000; Nachmias & Gilad, 2002). Henry (2006) describes the location of information as an important “gatekeeper” skill that largely determines the effectiveness of online reading comprehension.

Perhaps the easiest way to observe the importance of these online reading comprehension skills is to observe adolescents reading the results page from a search engine like Google. Most will not actually read any items on the results page. Instead, the majority will use a simplistic “click and look” strategy. They will begin at the top of the list, clicking on each result and quickly viewing the image at each web page that appears to see if its visual appearance matches their needs (Guinee, Eagleton, & Hall, 2003; Henry, 2006). Indeed, they will not even appear to “read” any of the search result descriptions, only the linked pages they visit as they work their way down the list of search engine results. Knowing how to read search engine results often discriminates between good and poor online readers.

*Analysis.* Critical analysis and evaluation is a skill we want all readers to acquire for both offline and online texts. Our work with more proficient online readers in urban and rural classrooms (Leu & Castek, 2006) shows that students are frequently fooled about the reliability of the information they locate, even when they know that one can not trust information on the Internet. Despite telling investigators that one should not trust the information on the Internet, a majority of proficient online readers in this study thought that a spoof site, *Save the Pacific Northwest Tree Octopus* (<http://zapatopi.net/treeoctopus/>) provided reliable information.

Coiro (2006) has found at least five different types of evaluation that take place during online reading comprehension: 1) Evaluating understanding: Does it make sense to me? 2) Evaluating relevancy: Does it meet my needs?; 3) Evaluating accuracy: Can I verify it with another reliable source? 4) Evaluating reliability: Can I trust it? and 5) Evaluating bias: How does the author shape it?

Of course, each of these also takes place in offline environments. Some aspects of online evaluation, however, require new skills and strategies because of the new ways in which information is presented on the Internet.

For example, it is important to know how to evaluating search engine results to know which website to go to first. Is the site created by a .org (organization), .com(company), .edu(academic/school) or by something else? Once deciding which site to investigate, critical evaluation continues. Where should I go to determine who is the author? What is her background? How does she shape the information she provides on the Internet? Do any other sites corroborate her information? We want our students to become healthy skeptics as they ask these and many other questions while reading on the Internet. Analysis and evaluation become especially important online, since anyone may publish anything.

*Synthesis.* While we have found synthesis to be a central component of online reading comprehension, we have also found it to be the most challenging one to study. Much of synthesis takes place in the mind of the reader. The process happens so quickly and is not usually visible so it is extremely hard to observe in ways that provide visible patterns.

As they seek answers to questions and solve problems, online readers synthesize texts in at least two ways. First, of course, they synthesize the meaning of the texts as they do with offline texts, putting together an understanding of what they have read. In addition, though, readers synthesize texts in a second way: they actively construct the texts that they read through the choices they make about which sites to visit, which links to follow, whom they communicate with, and whose messages they choose to read as they seek answers to the questions that direct their online reading. No two readers construct the same physical text online, even though they may have the same question or problem to solve. While choosing texts to read occurs offline, of course, this does not happen to nearly the same extent, with nearly the same speed, nor with units of text that are nearly so short. Intertextuality (Hartman, 1995) defines online reading; far too often it is merely a possibility offline in school classrooms. We are in need of much more work on the intertextual synthesis of meaning that occurs online.

*Communication.* Many new communication tools become available on the Internet, each with its own affordances and each developing its own set of social practices. Thus, each requires its own set of strategies. Because reading and writing become fused in this fashion on the Internet, we have included communication within our comprehension model. Email, instant messages, chats, blogs, wikis, discussion boards, phone, and video conferencing are just a few of the tools individuals use to read and comprehend on the Internet today.

*How Do Students Acquire The Skills, Strategies, And Dispositions Required for Online Reading Comprehension?*

How to support students in acquiring the new literacies of online reading comprehension is also little understood. Several observations, however, suggest that these are likely to be acquired best through social exchange and construction rather than formal, direct instruction. Since literacy is deictic (Leu, 2000), no single person, such as a teacher, can keep up with the many new literacies that rapidly and continuously appear online. Instead, each of us has to depend upon others to help us acquire the continuously new literacies of online reading comprehension. I may know a useful strategy with Google, but you may know an equally useful strategy to help me communicate information at a wiki.

In the past, instruction has been based on the assumption that teachers were always more literate than students. This assumption is no longer true. The odds that teachers will be less literate than the collective knowledge which exists in any single classroom increases as these new literacies become increasingly multiple (New London Group, 2000). As ever newer literacies appear and fragment our literacy landscape, it should be increasingly expected that at least one student will always know more than any teacher about some aspect of online reading comprehension. New models of instruction will need to take advantage of this intellectual capital that will be increasingly distributed around a classroom -- the new literacies that students possesses and that teachers do not.

This speculative analysis, of course, does not suggest that teachers will become less important in classrooms of the future. Indeed, just the opposite will be true. Teachers become more important, though their role changes, within new literacy classrooms. The more socially mediated learning aspects of online reading comprehension create more complex contexts that will have to be more thoughtfully orchestrated by teachers so that all students can bring their special

insights about new literacies to the learning task.

## ISOMORPHIC AND NON-ISOMORPHIC EXAMPLES OF OFFLINE AND ONLINE READING COMPREHENSION

What does online reading comprehension look like? In this section we briefly describe the reading episodes of three seventh grade students completing the same set of online reading tasks. To evaluate the extent to which online and offline reading comprehension are isomorphic, we compare their online performance with their offline reading proficiency levels. To sustain an isomorphic hypothesis, students' online reading levels should match their offline reading levels. .

The common set of tasks in these videos required students to read three blog entries, each of which contained a request for assistance in an attached word document that needed to be downloaded. The first blog request asked students to: 1) locate two sites given partial information about each and post the URLs and the titles of these sites at the blog and then 2) evaluate the two sites, according to a given set of criteria, and determine which one was best, explaining why. The second blog request asked students to: 1) locate a site on the Internet with an animated graphic that met several criteria; 2) communicate the name and URL on the blog of the best animated graphic of the digestive system that they had located; and 3) communicate how one should check the accuracy of information at a site like this on the Internet. The third blog request asked students to complete an activity similar to the second one but to locate and evaluate the best animated graphic about the respiratory system. They were also asked to communicate additional ways to evaluate information on a site like this for accuracy.

Please view these videos of online reading at <http://www.newliteracies.uconn.edu/reading.html>. As you view the videos, you will see the complex way in which different elements of online reading intersect, revealing aspects of: question identification, location, evaluation, synthesis, and communication..



*The Isomorphic Reading Hypothesis: Riko, A Student Displaying Proficiency In Both Offline And Online Reading*

Riko is an example of a high achieving reader offline who also is highly proficient with online reading comprehension. His example supports the prevailing assumption that online and offline reading is the same. This hypothesis would predict that high achieving offline readers would also be high achieving online readers and that low achieving offline readers would also be low achieving online readers. Subsequent cases will raise questions about this belief.

*Offline reading level.* Riko's science teacher reports that he was an outstanding offline reader, able to read and understand a challenging 7<sup>th</sup> grade science text with little assistance from a teacher. This evaluation was sustained by his score on the reading portion of the Connecticut Mastery Test (CMT). Riko had a raw score on the CMT of 305. This falls in the range characterized as "advanced." Riko is an excellent offline reader.

*Online reading level.* In addition to doing well on the state reading assessment, Riko also did well on the ORCA-Blog assessment of online reading comprehension (Leu, Castek, Hartman, Coiro, Henry, Kulikowich, & Lyver, 2005). Among 89 students, he achieved the highest raw score, 30 out of 33.

Viewing the video of Riko's online reading, one can see a high level of performance on a number of intersecting elements essential to online reading comprehension: locating information, evaluating information, synthesizing information, and communicating.

In terms of locating information, you will see Riko first try to locate the Human Anatomy Online site using a search strategy we commonly see in lower performing online readers, simply typing in the name of the site he was asked to find plus ".com." (He mistakenly types in [www.humananatomy.com](http://www.humananatomy.com) but is blocked by the school filter to this location.) Then, however, he

shifts to a search engine and quickly locates the site that was requested, *Human Anatomy Online* (<http://www.innerbody.com/htm/body.html>)

In terms of evaluation, the tasks in these videos tend to focus primarily on the evaluation of understanding, relevancy, and reliability. On each of these three aspects of evaluation, Riko performs well: he often rechecks his understanding of the document containing the request. He also evaluates sites for relevancy and he communicates strategies that he recommends to evaluate reliability.

In both synthesis and communication, Riko performs well. He correctly synthesizes information and clearly communicates it in his blog postings. This blog may be a new Internet context but Riko appears to figure things out nicely, even when problems appear.

In short, viewing this video provides one with a sense that Riko is able to effectively traverse a complex set of informational windows and complete the tasks that were asked of him. Riko's performance in online reading is what one would expect if online and offline reading were the same.

*The Non-Isomorphic Hypothesis: Tomas, A Very Low Achieving Offline Reader But a High Achieving Online Reader*

Tomas provides an example one should not expect to find if online and offline reading are isomorphic. He is a very weak offline reader, being provided with supportive services as a student with a specific learning disability in reading. Surprisingly, however, he was among the top 15% of online readers in our sample.

*Offline reading level.* Tomas' science teacher reports that he was a very weak offline reader; seventh grade science books were too difficult for Tomas to read, even with significant instructional support. His below level reading skills were a documented component of his

specific learning disability. He received daily instructional support from a trained special educator who worked closely with all of his teachers to develop modified assignments and provide simplified instructional materials. His score on the recent Connecticut Mastery Test (CMT) sustained this evaluation. Tomas had a raw score on the CMT of 167. This falls in the range characterized as “below basic.”

*Online reading level.* While Tomas performed poorly on the state reading assessment, he performed at a high level on the ORCA-Blog assessment of online reading comprehension. Among 89 students, he achieved the tenth highest raw score, 22 out of 33. (As in all other assessment settings, Tomas was provided with additional time to complete the online assessment. He was given about ten additional minutes, 40 minutes instead of 30.) From the video, one can see successful performance on each of the three tasks. These include slow, but very skilled patterns on a number of intersecting elements: locating information, synthesizing information, and communicating. Tomas did less well during the evaluation of information.

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While Tomas is slow, it is immediately apparent that he makes very strategic and thoughtful decisions while reading online. He carefully organizes multiple windows so he can traverse quickly between the task description and the search engine. He also enters very appropriate key words for each search. In addition, he reads each list of search engine results, usually selecting the correct site. He also knows how to copy and paste the URL for a site in the blog to communicate the location. He uses thoughtful online reading strategies to locate graphics for digestive and respiratory systems though, perhaps because of a vocabulary issue he may not have

understood what animated meant. (Half credit was given to students who found a graphic illustration that was not animated.)

Tomas also figured out the skills required to use this blog. He downloaded each document and posted entries for each of the three tasks. His communication skills, with the exception of some spelling issues, seemed quite adequate.

Tomas' weakest area of online reading comprehension was evaluation. Note, for example his final entry about evaluation that he posted on the blog: "I don't think it mater who made the site aslong as it was good information and no adervertisement i don't think you need who made the site." Ignoring the spelling mistakes, we see that Tomas is somewhat naive and not fully aware of how people inevitably bias information they provide readers on the Internet.

Despite the more limited understanding of critical evaluation skills, this was not a performance one would expect from a student at a "below basic" level who requires instructional support for any assignment in class using offline materials. It suggests that readers who struggle with offline materials may not struggle with online materials to the same extent, as long as they have the skills and strategies essential to online reading comprehension.

*The Non-Isomorphic Hypothesis: Marcos, A Very High Achieving Offline Reader But a Low Achieving Online Reader*

Marcos also provides an example one should not expect to find if online and offline reading are isomorphic. He is a high achieving offline reader but a surprisingly low achieving online reader. His case also provides evidence that there are additional new reading comprehension skills required during online reading comprehension.

*Offline reading level.* Marcos' science teacher reports that he was an outstanding offline reader, able to independently read and understand a challenging 7<sup>th</sup> grade science text. His score

on the Connecticut Mastery Test (CMT) sustained this evaluation; Marcos had a raw score on the CMT of 302, nearly the same as Riko's. This falls in the range characterized as "advanced." Marcos, like Riko, is an excellent offline reader.

*Online reading level.* Marcos did not perform well on the ORCA-Blog assessment of online reading comprehension. Among 89 students, he achieved a raw score of 7 out of 33, in the bottom quartile of all online reading comprehension scores.

Comparing Marcos to Tomas' reminds one of the classic story of the tortoise and the hare. While Tomas read slowly, he outperformed Marcos with his steady pace since he knew effective strategies for completing the tasks. Tomas found things efficiently and completed all three tasks. Marcos, on the other hand, moved very quickly among sites. He clearly had some ideas about locating information but moved too quickly and took short cuts that hurt him. Because he had a hard time getting back to sites he had visited and because he did not know how to copy and paste a URL, he made many errors and, ultimately, ran out of time and failed to complete the third task. Distracted by his inability to locate items, he failed to include the title of the sites in any of his answers. Finally, because he could not get back to some of the sites, he appears to have made up some of his evaluation comments. Marcos looks like he has some online reading skills but is missing other crucial ones. As a result, he ends up being very inefficient during online reading.

#### *What Do These Videos of Online Reading Comprehension Reveal?*

These examples teach us several important lessons. First, they reveal that online reading comprehension typically is organized around several different elements, often taking place simultaneously or recursively. In each video we see how online reading often begins with a question or a problem, and contains elements of locating, evaluating, synthesizing, and communicating. These define online reading comprehension.

Second, these examples also illustrate how online reading is the reading of informational texts, not typically the reading of narrative texts. The Internet is a major new source of information that can be used to solve problems and answer questions. Online reading comprehension is the comprehension of informational text to learn and discover.

Third, we see how online reading comprehension appears to require skills, strategies, and dispositions that are likely to contain new aspects that are not required during offline reading comprehension. Both types of reading may involve questions, location, evaluation, synthesis, and communication but each contains a somewhat different skill set because each depends on different technologies. In a book, one requires the ability to use an index and table of contents to locate information; on the Internet, one requires the new skills that a search engine demands.

We also see how intertwined reading and writing become since online reading often has elements of communication that take place simultaneous with comprehension. In online environments we read while we write and we write while we read.

Finally, we see how one must not assume that offline reading and online reading are the same. If they were isomorphic, high achieving offline readers should always be high achieving online readers and vice versa. Indeed, one of the most striking aspects of these cases is that we find a low achieving offline reader, one who has been formally identified because of reading difficulty, perform at a high level during online reading. This reader achieved in the upper quartile of all online readers, a somewhat surprising outcome. Conversely, we saw how one of the highest achieving offline readers was unable to accurately complete the online reading task at the same level as this LD reader. Isomorphism does not exist between offline and online reading comprehension.

#### ISSUES FOR BOTH RESEARCH AND PRACTICE

This review of research helps us to understand that the Internet has become a central context for reading and that reading changes in important ways online. It also tells us that far too little research has focused on the nature of online reading comprehension since we have often assumed it to be identical to offline reading comprehension.

The video examples of online reading provide visible examples of what online reading looks like, a rich and complex mixture that typically begins with a question and includes locating, evaluating, synthesizing, and communicating, often in unique informational genres and with new online tools such as search engines, blogs, attachments, email and others. Because online reading comprehension begins with a question and because new technologies for literacy are required, new literacies are required to accomplish traditional aspects of reading during the comprehension process.

The examples also show us how we should not assume that low achieving offline readers are necessarily low achieving online readers, or vice versa. To do so is likely to misjudge each student's potential and each student's instructional needs.

The mistaken assumption that online reading comprehension is the same as offline reading comprehension is unfortunate but we see it throughout the educational system. It is most visible, perhaps in state reading assessments. Not a single state reading assessment measures students' ability to read search engine results; not a single state reading assessment measures students' ability to critically evaluate information that they read online; and not a single state reading assessment includes the reading of email messages, blogs, or wikis (Leu, Ataya, & Coiro, 2002).

This suggests that our current policies, with their focus on testing skills and strategies required for offline reading, but not online reading comprehension, may be exacerbating the very problem they seek to solve.. Economically challenged school districts currently have little

incentive to include online reading comprehension skills in the instructional program since they are under the greatest pressure to raise reading test scores on assessments that have nothing to do with online reading comprehension. As a result, many students go unsupported in developing the new literacies of online reading comprehension in school. This is especially true for those students who require our support the most -- those who have access to the Internet at home the least

The failure to understand that online reading requires new skills and strategies is not limited to assessments, however. It is a systemic failure. We require teachers who are literate themselves with these new literacies, school leadership teams who understand why it is essential to integrate the Internet into literacy education, state reading and writing standards that include new literacies in their lists of essential skills, and reading and writing curriculum that provide instructional support in how best to integrate new literacies into classroom lessons. To continue to ignore this systemic failure is to continue our failure to prepare students for the new literacies of the twenty-first century.

### *What Should We Teach?*

While early work on the nature of the skills required to effectively read and comprehend information online has established a broad outline of what is required, more research is required to completely understand all of the skills and strategies essential to online reading comprehension. In addition, we need to recall that the rapidly changing nature of the Internet may make a complete taxonomy of these skills a Sisyphean task. Nevertheless we know that online reading comprehension almost always begins with a question or a problem to solve, usually is limited to informational texts, and requires new skills and strategies to navigate the complex and rich informational space that defines the Internet. Initial research (Coiro, 2006;



Coiro & Dobler, in press; Henry, 2006; Leu, et. al, 2004) as well as the video examples presented earlier suggest that new comprehension skills appear in five areas: developing an important question, locating information online, critically evaluating information that readers locate, synthesizing across texts to determine a likely answer, and communicating their discoveries to others.

*How Should We Teach These New Literacies of Online Reading Comprehension?*

The answer to this question is not yet clear since so little research has been undertaken to study online reading comprehension in classroom learning contexts. We do know that students at the seventh grade level acquire online reading comprehension skills as rapidly from exchanging them in small groups as through more formal instructional lessons (Castek, Leu, Coiro, Kulikowich, Hartman, & Henry, 2006). This suggests that socially mediated experiences may be especially useful as instructional models are developed for teaching the new literacies of online reading comprehension. Thus, models such as Internet Workshop (Leu, 2001; Leu, Leu, & Coiro, 2004), Internet Project (Harris & Jones, 1999; Leu, 2002), Internet Inquiry (Leu, Leu, & Coiro, 2004), and Internet Reciprocal Teaching (Castek, 2006) may be important starting points. Clearly, though, we require an aggressive research agenda to fully explore the important efficacy issues in teaching and learning the new literacies of online reading comprehension.

### THE CONSEQUENCES OF CHANGE

This chapter has attempted to show how change is required in our conception of reading comprehension. New online reading comprehension skills and strategies will be required as, increasingly, our reading worlds move to the Internet. Traditional notions of reading comprehension, traditional methods of assessment, and traditional curriculum materials will not be sufficient to adequately prepare students for the new literacies they will require online.

Perhaps the first, and most important, step on this journey is to recognize that changes in online reading comprehension do take place on the Internet. Preliminary work (Coiro, 2006; Coiro & Dobler, in press; Henry, 2006; Leu, et. al, 2004) suggests this; the videos of online reading comprehension presented in this chapter illustrate it. Realizing that we need to reconsider the nature of reading comprehension on the Internet is not a minor accomplishment. From it many other consequences of change are possible.

It would then be possible, for example, to bring more researchers to study the issue, providing a more precise roadmap for instruction. It would also be possible to include the new literacies of online reading comprehension in reading assessments. Additionally, it would be possible to provide the additional technology resources to schools that would permit full access to the reading materials on the Internet, whenever a student required it. It would also be possible to prepare teachers to more fully understand how best to integrate instruction in online reading comprehension instruction in all subject areas. Understanding the nature of the issue would also make it possible to provide current classroom teachers with the extensive professional development to enhance their own new literacies skills while also providing them with instruction in how best to integrate models such as Internet Workshop, Internet Project, Internet Inquiry, and Internet Reciprocal Teaching into their classroom curriculum. Most importantly, however, it would make possible the goal that every teacher seeks -- -- to ensure that all of our students are fully prepared in reading so they might each fulfill their dreams and make our world a better place through their accomplishments.

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## Figure Caption

*Figure 1.* A video recording of the online reading comprehension performance by the weakest reader among 89 seventh grade students. This student was among the highest achieving online readers. View this video at <http://www.newliteracies.uconn.edu/reading.html> You may require QuickTime, a free plug in available at <http://www.apple.com/quicktime/download/mac.html>.

Figure 1.

